Social Context and Geographic Patterns of Homicide Among US Black and White Males

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A B S T R A C T

Objectives. The recently published *Atlas of United States Mortality* depicted striking regional differences in homicide rates for Black and White males in the United States. This study examined these rates to gain an understanding of the contribution of social context to geographic variability in homicide.

Methods. Homicide rates were calculated by health service area for the years 1988 to 1992. The contributions of age, geographic location, urbanization, and sociostructural characteristics were evaluated by means of a weighted linear mixed effects model.

Results. Regional differences in urbanization explained much of the geographic variation in homicide rates, but sociostructural factors also had a significant impact. The results suggest that these effects operate similarly for White and Black males, although differences were found in the magnitudes of the effects for the 2 groups.

Conclusions. Results point to a strong association between homicide and urbanization and socioeconomic conditions in all regions of the country for both Black and White males. These findings shed light on the potential correlates of high homicide rates in the United States in the near future. (*Am J Public Health.* 2000;90: 579–587)

As a leading cause of death in the United States, homicide is an important public health problem that may be investigated with epidemiologic tools. From public health research to date, we have learned a great deal about the impact of homicide on the population as a whole and the patterns within various subgroups (i.e., by sex, race/ethnicity, and age). In 1997, homicide claimed the lives of 19 846 US residents. Overall, homicide ranked 13th of all causes of death but ranked in the top 5 among Black and Hispanic men and second among all 15- to 24-year-olds, the age group with the highest homicide rates.[1] Age-adjusted homicide rates are much higher for Black males than for White males (51.5 vs 7.0 per 100 000 population in 1996), and rates are higher for males (regardless of race) than for females (12.5 vs 3.5 per 100 000 population). Age-adjusted rates began to decline in 1994 after a period of rising rates.[2,3]

There is substantial variation in US homicide rates by region and degree of urbanization. Maps in the *Atlas of United States Mortality* showed higher homicide rates in the southern United States than in the northern part of the country, and rates in metropolitan areas were higher than elsewhere, especially for Blacks.[4] Fingerhut and colleagues also found that homicide rates for teenagers and young adults were highest in core metropolitan counties; rates in these counties were 4 to 5 times higher for males and at least 1.5 times higher for females than in nonmetropolitan counties.[5]

Causes of homicide have been the subject of much debate and analysis. One area of research has focused on the social and structural correlates of homicide across various levels of aggregation (i.e., health areas, cities, metropolitan areas, states). Shaw and McKay advanced the theory that social disorganization in a community leads to increased crime.[6] According to Sampson, "the theory of social disorganization refers to the inability of a community structure to realize the common values of its residents and maintain effective social controls."[7(p66)] This structural explanation of homicide has been argued to operate similarly for all races. Empirical research supports these theories.[8–11]

Another approach focuses on socioeconomic deprivation, often measured according to the federal poverty level. Strain theorists see economic hardship and lack of access to legitimate economic opportunities as causing frustrations that may lead to crime, arguing that crimes are "instrumental" acts (i.e., the assailant's primary motive is to acquire money or property).[12] In addition, evidence exists that relative deprivation (as measured by degree of income inequality), rather than absolute deprivation, is an important correlate of homicide.[8,13]

Other research focuses on a "subculture of violence" theory, according to which a subculture exists that values violence as a legitimate means of interaction,[14] such as in the South or in areas where the percentage of Black residents is high. While research exists to support both socioeconomic and cultural correlates of homicide,[15] other compelling work has concluded that a subculture of violence theory cannot be supported on either theoretic or methodological grounds.[11,16,17]

In this study, we examined how well these theories could explain the homicide patterns shown in the *Atlas* maps.[4] We reanalyzed homicide death certificate information from the *Atlas* for communities across the United States to determine whether sociostructural variables—specifically, measures of social disorganization and socioeconomic

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deprivation—explain geographic variations in rates.

Methods

Data

The numbers of homicides, including those resulting from legal interventions (*International Classification of Diseases* codes E960-E978), among males during 1988 to 1992 were summarized by race (Black and White), age (10 categories ranging from 0–4 years to 85 years and older), and area of residence. Note that persons of Hispanic origin were not assessed separately but were classified by race (primarily White). Low rates precluded analysis of homicides among women. We computed age-specific rates with 1990 census population values multiplied by 5, representing person-years at risk for the 5-year period.[18,19] Further details are available elsewhere.[4]

Areas of residence of the decedents in the continental United States, originally reported at the county level, were aggregated to 798 health service areas, groups of counties that are relatively self-contained with respect to location of hospital care.[20] Regions were defined by census division boundaries, except that the South Atlantic division was subdivided so that no region comprised more than 6 states (an outline of the states included in each region is available from the authors). Each health service area is completely contained within a region. Because information on Hispanic origin was not collected by some states before 1989, and because Hispanic males evidence high homicide rates, health service areas in the highest decile with regard to percentage of Hispanic residents (>12.5%) were designated "high Hispanic health service areas" for modeling purposes.

Sociostructural variables available at the county level were aggregated to the health service area level via population weights.[21] Factors included as explanatory covariates in the model were urban/rural status, absolute deprivation (a measure assessing median family income and percentages of residents who had graduated from high school, who were unemployed, and who lived in crowded housing conditions [average of more than 1 person per room]), relative deprivation (assessed with the Gini coefficient,[22] a measure of income inequalities within health service areas), and social disorganization (assessed as percentage of female-headed households). The Gini coefficient was chosen because it is a well-known measure and has a simple interpretation: values range from 0, indicating total equality of income among residents, to 1, indicating extremes of income among residents.[23,24] Census data were used in creating the values for the Gini coefficient (M. Soobader, University of Rochester, unpublished SAS program). Highly collinear combinations of variables were not included in the model.

An urban/rural status code was created for each health service area as a weighted average of the urban/rural continuum codes for counties within that area,[25] weighted by county populations. These weighted averages were initially grouped via aggregation of the original 10-class scale to 5 classes. Because there were so few rural areas, these areas were combined with the next most populous class to form 4 urban/rural categories for analysis: large metropolitan (central and fringe metropolitan counties of 1 million population or more; n=78), small metropolitan (metropolitan counties of less than 1 million population; n=166), large nonmetropolitan (nonmetropolitan urban counties of 20 000 population or more; n=199), and small nonmetropolitan (nonmetropolitan urban counties of less than 20 000 population and completely rural counties; n=355). The large metropolitan class was the referent in the models.

For each of the other sociostructural covariates, binary variables were constructed that indicated whether the health service area was in the lowest or highest quartile of all health service areas. This allowed detection of nonlinear (e.g., quadratic) associations between the covariate and the logarithms of the rates. The referent category for each variable was the middle 50% of the health service area.

Statistical Analysis

Age-specific rates for each health service area were predicted for the *Atlas* from a model with only functions of age as covariates in each region. Maps of the predicted rates were further smoothed via a nonparametric algorithm[26]; resulting maps for White men and Black men aged 20 years are presented here (Figure 1).

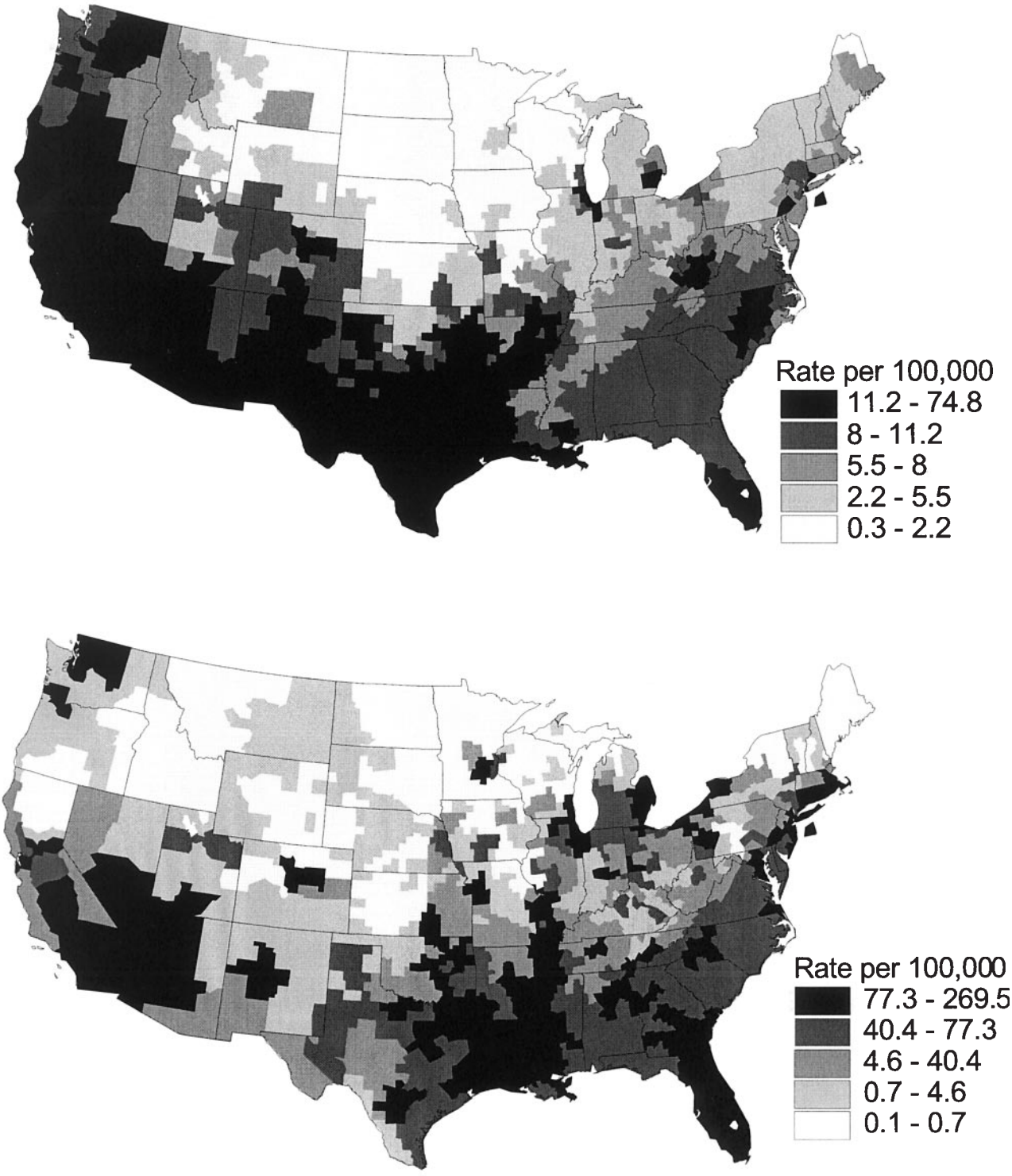
Extending the base model from the *Atlas,* we evaluated the contributions of age, geographic location (health service area), and the sociostructural factors by means of a weighted linear mixed effects model.[4,27] That is, the logarithms of the rates specific to age and the rates specific to health service area were modeled as a linear function of age, region, the sociostructural variables, and those variables' 2-way interactions. For White males, the intercept for each health service area was assumed to vary randomly around an overall regional regression effect, implying that the rate curves for health service areas within a region are parallel. Only fixed effects were estimated for Black men because of the sparseness of their data. Data for White men and Black men were analyzed separately.

SAS PROC MIXED[28,29] was used in estimating regression coefficients; weights were equal to the square root of the expected numbers of deaths for each age–health service area combination. No significant spatial correlations were found in the initial analyses, so none were included in the final model. Age and region effects and their interactions were included in all models, regardless of their significance levels. Sociostructural variables remained in the model only if they were significant (likelihood ratio test, $P<.05$) or if they interacted significantly with another variable; interactions remained in the model only if they were highly significant ($P<.01$). Chi-square tests,[30] residual plots, and comparisons of observed and predicted maps were used to judge the fit of the models. Predicted log rates and their standard errors for important combinations of sociostructural factors were computed with PROC MIXED; 95% confidence intervals were constructed from these values and then converted to the original scale (rate per 100 000 population) for presentation.[31]

Results

The observed age-adjusted homicide rates during 1988 to 1992 were 8.7 per 100 000 population among White males and 66.2 per 100 000 among Black males in the United States. However, these overall rates mask the great variability in observed rates across the country. For example, some health service areas saw no homicides at all during this period, while 10% of the areas had age-adjusted rates above 12.4 per 100 000 among White males and above 74.2 per 100 000 among Black males. Maps of rates predicted from the *Atlas* basic model reflect the broad geographic patterns in the observed data. For example, predicted rates among 20-year-old men were generally higher across the southern states and in major metropolitan areas for both Whites and Blacks (Figure 1). Geographic patterns for other ages were similar to those shown here. Rates in most regions were higher for Black men than for White men, although the reverse was true in the Southwest, perhaps owing to a high concentration of Hispanic White residents, who are at higher risk for homicide than non-Hispanic Whites.[1]

The full models used to analyze these data fit significantly better than the basic *Atlas* model (full model vs region and age effects model: likelihood ratio $\chi^2_{13}=379.4$, $P<.001$, for White males; $\chi^2_{37}=3690.4$, $P<.001$, for Black males). Overall goodness-of-fit statistics indicate that the model fit the White male



Note. Rates were predicted from a model including only age and region effects and then were smoothed, by means of a nonparametric algorithm, to bring broad geographic patterns into better focus. Data were derived from Pickle et al.[4(pp153,155)]

FIGURE 1—Predicted homicide rates for White (top) and Black (bottom) men aged 20 years: United States, 1988–1992.

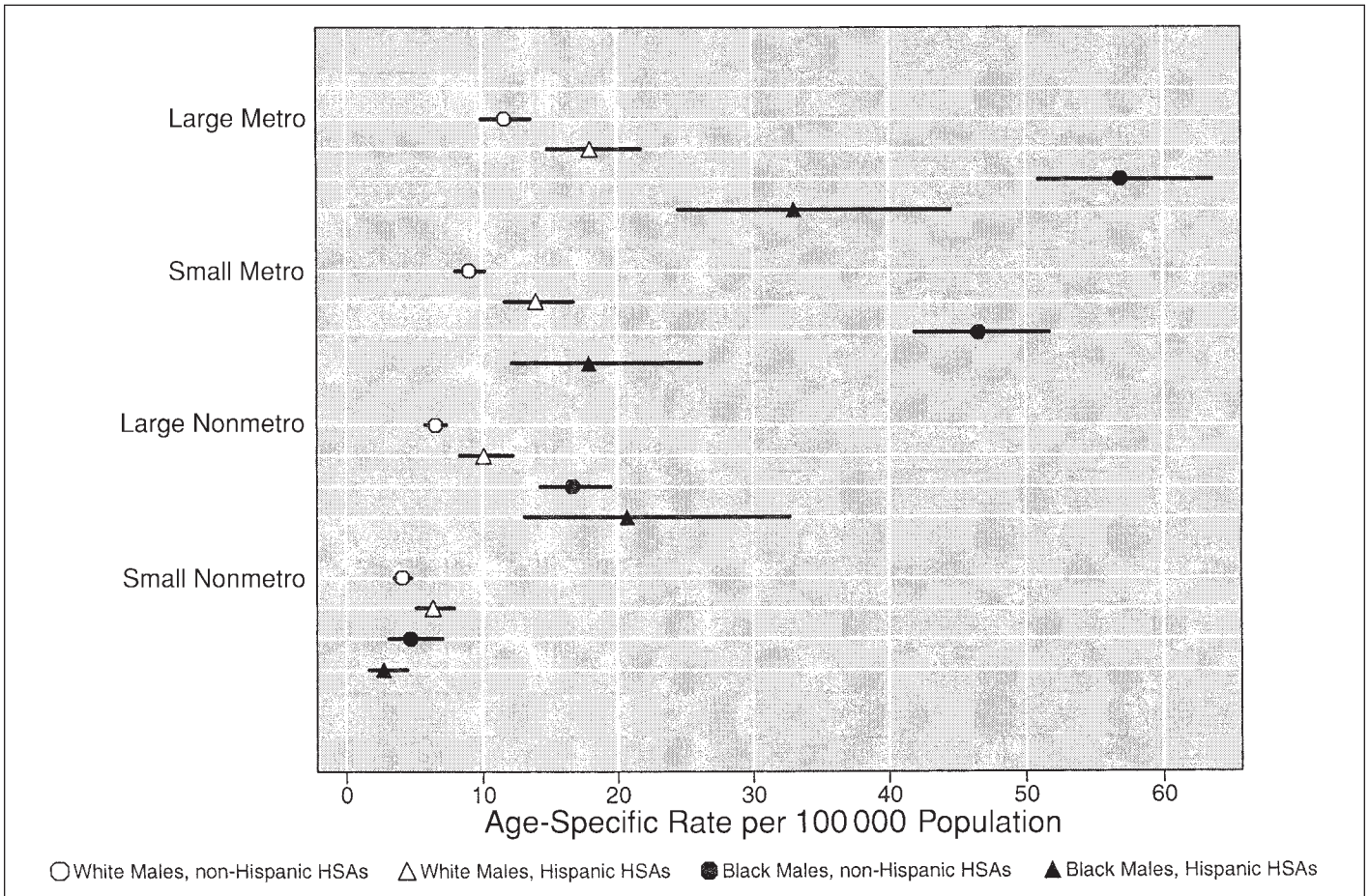
data very well ($\chi^2_{7944} = 5494.3$, $P > .99$). The random intercept term captured a significant portion of the total variation among White males ($P < .001$). The overall goodness-of-fit statistic suggested a poor fit for the Black male data ($\chi^2_{7920} = 12414$, $P < .001$), but most of the extreme outliers involved small populations in which a fractional death (i.e., <1) was predicted but none occurred. Fractional death predicted means that the number of deaths was predicted to be between 0 and 1, but only integer number of deaths can be observed (i.e., 0,

1, 2). Several major cities had more deaths than predicted for both White and Black men.

Age was by far the strongest predictor of homicide rates for both White and Black men, followed by level of urbanization. As expected from patterns in nationwide data, the model predicted that homicide rates decline after the age of 20 years. Increasing urbanization was associated with increasing homicide rates, with larger differences seen for Black men. For both groups, regional effects were significant, and most of these effects were modified by age (e.g., higher rates for older men occur in areas of the Southeast and in the West South Central region). Homicide rates were significantly higher for both White and Black men living in areas with low educational levels or high levels of income inequality, and rates were significantly lower in areas with a low prevalence of crowded housing conditions. Rates were also high for White men living in health service areas with a large percentage of Hispanic residents and for Black men in areas with higher income levels or more female-headed households. Regression coefficients from the full models are available from the authors on request.

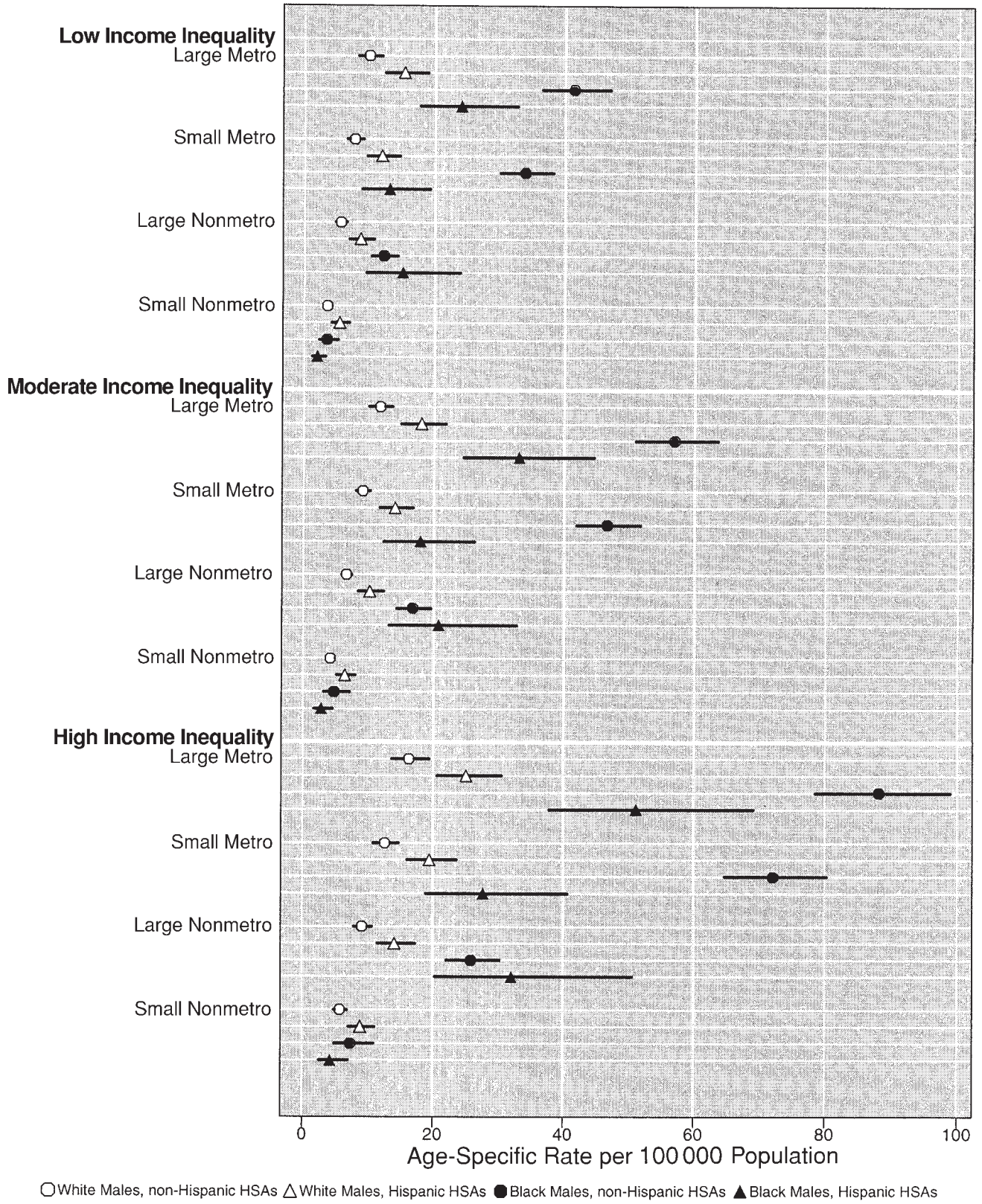
Because a third of all homicides occurred among persons aged 15 to 24 years, we selected the age of 20 years to graphically display homicide rates according to factors identified as important predictors in the models. Figures 2 through 5 present graphs of homicide rates and their 95% confidence intervals for the years 1988 to 1992, as predicted by the model, for 20-year-old Black and White men. Regional effects were averaged; other factors were assumed to be equal to their referent values. As noted, other than age, urbanization had the greatest effect on the rates of homicide for both Black and White men. For these reasons, each graph shows rates stratified by urbanization in addition to other significant sociostructural variables.

The combined effects of degree of urbanization and a high percentage of Hispanic residents were striking (Figure 2). For every urbanization category, homicide rates for White men were higher in areas where there were more Hispanic residents, but the reverse was generally true for Black men. In these Hispanic areas, Black rates were significantly higher than White rates in the larger metropolitan and nonmetropolitan categories. However, in the smaller nonmetropolitan categories, rates for White men living in areas with large percentages of Hispanic residents were significantly higher than rates for Black men residing in those same areas and for men living in other regions. Otherwise, there were no significant differences between White men and Black men residing in these more rural communities. Because of the importance of high percentage of Hispanic residents in differentiating geographic differences in homicide rates, this effect was combined with degree of urbanization in the remaining graphs.



Note. See text for urban/rural category definitions. Hispanic health service areas (HSAs) = areas with more than 12.5% Hispanic residents.

FIGURE 2—Estimated homicide rates and 95% confidence intervals, by level of urbanization and by race and percentage of Hispanic residents, among men aged 20 years: United States, 1988–1992.

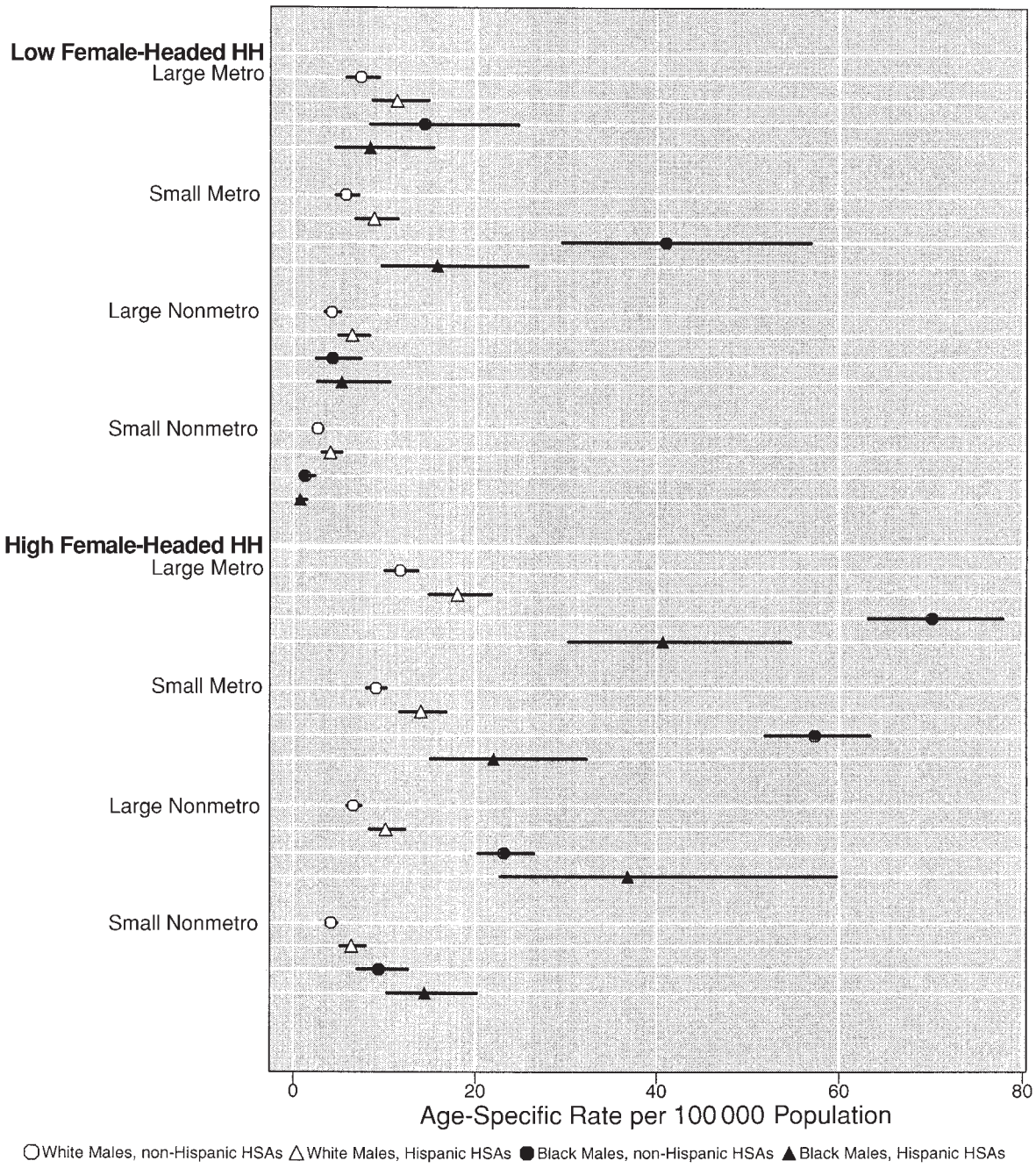


Note. See text for urban/rural category definitions. Low income inequality = bottom quartile of all HSAs; moderate income inequality = middle 50%; high income inequality = highest quartile. Hispanic HSAs = areas with more than 12.5% Hispanic residents.

FIGURE 3—Estimated homicide rates and 95% confidence intervals, by degree of income inequality within health service areas (HSAs) and by level of urbanization, race, and percentage of Hispanic residents, among men aged 20 years: United States, 1988–1992.

The effects of income inequality on homicide rates are clearly demonstrated in Figure 3. For each level of urbanization and Hispanic population, rates for both Black and White men in areas with the highest levels of inequality were approximately double those in areas with the lowest levels. Generally, rates for Black men were significantly higher with increasing urbanization and increasing income inequality.

The effects of the model interaction between urbanization and levels of female-headed households are shown in Figure 4. There was a gradient of increasing homicide rates with increasing urbanization for both White and Black men in areas with a high proportion of households headed by women. In areas where this proportion was low, how-

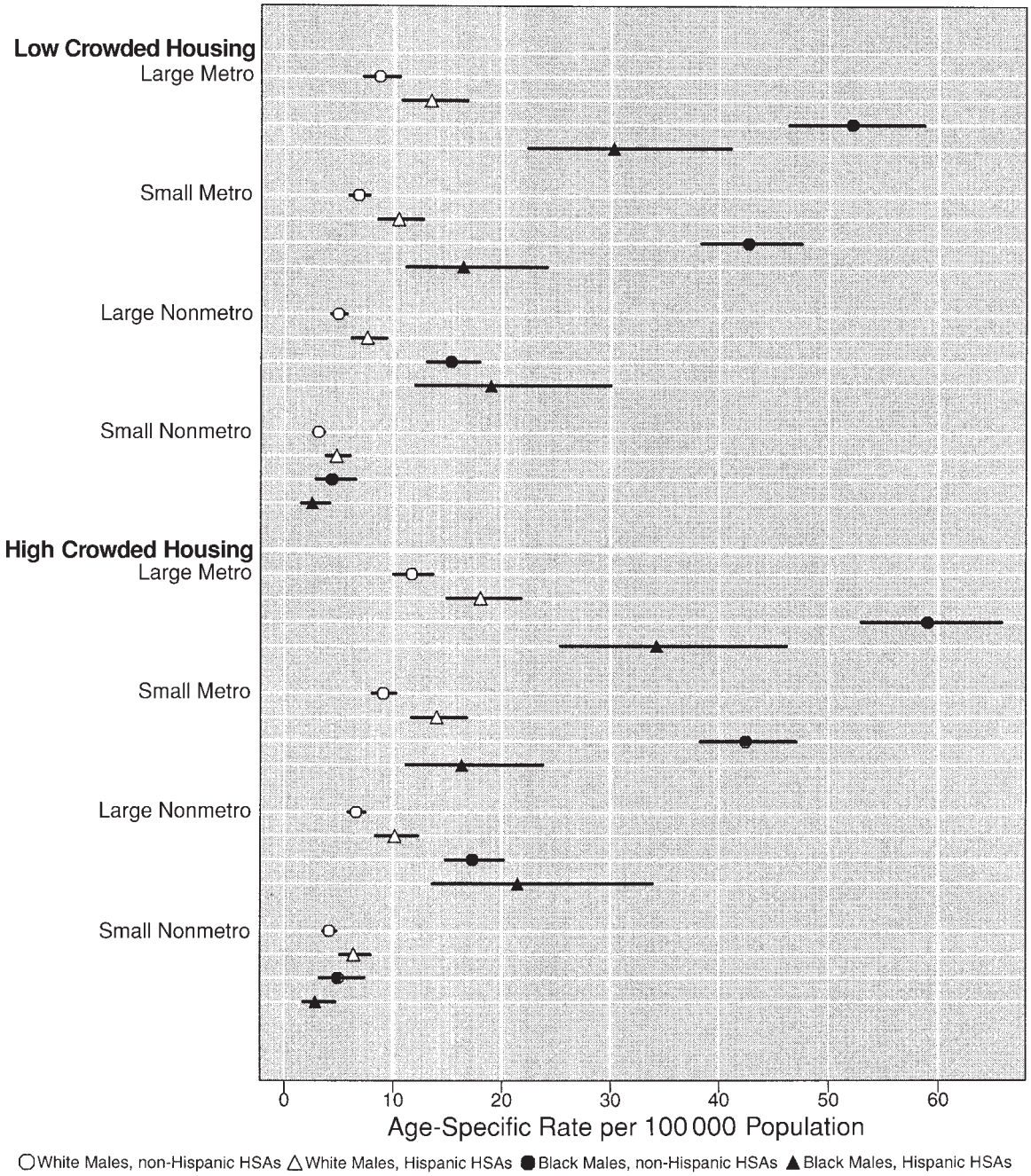


Note. See text for urban/rural category definitions. Low female-headed HH = bottom quartile of all HSAs in terms of percentage of households headed by women; high female-headed HH = highest 75% of all HSAs. Hispanic HSAs = areas with more than 12.5% Hispanic residents.

FIGURE 4—Estimated homicide rates and 95% confidence intervals, by percentage of health service area (HSA) households (HH) headed by women and by level of urbanization, race, and percentage of Hispanic residents, among men aged 20 years: United States, 1988–1992.

ever, the Black male homicide rate was actually higher in the smaller metropolitan categories than in the larger categories. In nonmetropolitan areas of any size where there were fewer female-headed households, White male rates were higher than Black male rates.

Figure 5 shows that homicide rates in areas with more crowded housing conditions increased somewhat at each level of urbanization; except for the smallest nonmetropolitan areas, Black-White differences were substantial. The plot for percentage of residents completing a high school education resembled this graph. Because unemployment and median income were significant for Black men only, we chose not to present graphs stratified by these variables.



Note. See text for urban/rural category definitions. Low crowded housing = bottom quartile of all HSAs in terms of rates of crowded housing conditions; high crowded housing = highest 75% of all HSAs. Hispanic HSAs = areas with more than 12.5% Hispanic residents.

FIGURE 5—Estimated homicide rates and 95% confidence intervals, by percentage of health service area (HSA) households living in crowded conditions and by level of urbanization, race, and percentage of Hispanic residents, among men aged 20 years: United States, 1988–1992.

Discussion

While surveys, death certificate information, and crime statistics at the national level are useful for describing trends and broad demographic patterns, they are less useful for understanding social and economic conditions that could affect homicide. Conversely, studies of individuals in a few small geographic areas may identify causes of homicide in those communities, but these studies can do little to explain variations in homicide rates in other parts of the country. The primary objective of our analysis was to determine the degree to which socioeconomic characteristics and urbanization improved the prediction of small-area homicide rates across the entire United States relative to a basic model including only age and region effects. We have shown significant improvement in predictions for both Black and White men.

Moreover, our results suggest that the effects of these additional factors are similar among Blacks and Whites, supporting previous findings.[7,10,17] Even for factors whose effect magnitudes were different among Black and White males, the effects were in the same direction for the 2 groups. Unmeasured differences in social and residential isolation, perhaps more appropriately captured at a lower level of geographic aggregation or for individuals, may explain some of the differences in the magnitudes of the effects.

The models reported here fit the homicide data significantly better than the simple age and region effects models used for the *Atlas of United States Mortality,* an indication of the importance of sociostructural factors as predictors of homicide rates. The complex model borrows information for parameter estimation from all areas with similar sociostructural profiles, and thus it can predict rates even in areas with sparse populations. Therefore, we were able to examine patterns among Black males despite the limited number of deaths among this group in any single health service area. The larger confidence intervals for Black male rates reflect a smaller overall population than the population of White males; even so, significant differences can be seen between the strata.

Level of urbanization was the strongest predictor of homicide rates after age for both White and Black men, and the highest rates were seen in major metropolitan areas, consistent with findings recently reported on homicide time trends.[5] Greater differences in rates were seen between urban and more rural areas for Black men. Rates for Black and White men were not significantly different in the least urban areas. These results suggest that other factors, as yet unaccounted for, could explain the higher homicide rates in major metropolitan areas.

Income inequality within a health service area was related to both Black and White homicide rates, suggesting that income disparity among residents, more so than median income level, is an important determinant of homicide. This finding is consistent with previous work.[8,13] In one study of income inequality and various health outcomes across US states, the strongest correlations were with homicide and violent crime.[13] Our findings support social deprivation theory; that is, the significant influence of income inequality suggests that higher homicide rates in the South are due not to a "subculture of violence" but, rather, to the higher levels of income inequality found there.

Previous work on income inequality has revealed threshold effects; for example, at lower absolute income levels, both median income and income inequality are important.[32] When median income is high, however, only the inequality effect is important, because the absolute income threshold has been exceeded. Our results are consistent with previous findings: significant effects for both median family income and income inequality were found only for Black males (who live in communities with lower levels of absolute income than do White males); among White males, significant effects were found only for income inequality.

Percentage of Hispanic residents was found to be an important predictor of homicide rates among White men, consistent with patterns seen in the basic model maps (Figure 1). Death certificates used in some states before 1989 did not collect information on Hispanic origin. Because we wanted to center the time period covered in a census year to match sociostructural measurements but needed 5 years of data for model stability, we were unable to analyze Hispanics separately. However, nearly all Hispanics are classified as White, so the higher White male homicide rates in areas with a high proportion of Hispanic residents probably reflect the contribution of Hispanic males, who have higher homicide rates.[2]

Conversely, because so few Hispanics are classified as Black, the Black male model effects probably reflect regional differences between Blacks living in the southwestern states and those residing elsewhere. These rate differences by Hispanic origin may explain the geographic differences between young White and Black men living in the Southwest (Figure 1). That Black male rates are lower and that most of the sociostructural effects are different in this region suggest different homicide risk profiles for Black males living in the Southwest. Further research is needed to elucidate the reasons for these differences.

We found that low percentages of female-headed households were associated with decreased homicide rates among both Black and White men, but only rates for Black men were substantially greater in health service areas with high percentages of female-headed households. These results support social disorganization theory, according to which areas with high levels of family stability are more able to realize social norms (e.g., a safe, nonviolent environment) and to maintain effective social controls.[33] The finding that only Black male rates are affected by high percentages of female-headed households does not suggest that households headed by Black women are harmful per se. Indeed, it may reflect different socioeconomic conditions in racially segregated communities; that is, Black men live in areas with much higher concentrations of families headed by women, in addition to higher levels of poverty, social isolation, and poor housing. These unmeasured conditions may jointly reflect such communities' ability to maintain effective social controls against crime and violence, such as supervision of youth and preventing the sale and use of illegal products on their streets.[34,35]

Our results must be interpreted cautiously because of possible misinformation on death certificates and imprecision of sociodemographic data for geographic units consisting of several counties each. It must be kept in mind that our unit of analysis was place of residence, that is, the county of residence of the victim rather than the county in which the death occurred (and where the hospital pronouncing the death was located). Ideally for prevention activities, one would also know where the actual homicide took place; this information, however, was not coded from the death certificate.[36] Despite this potential problem, a strong gradient of rates was shown from the least to the most urban health service areas, suggesting that perhaps most homicides occurred in or near the area of residence.

Finally, it would be desirable to analyze the socioeconomic conditions of individuals or of a smaller geographic unit (e.g., a city or a neighborhood) to capture local variations in rates. Indeed, one recent study showed that characteristics of health areas in the Bronx (concentrated socioeconomic deprivation, overcrowded housing, population change) were associated with the incidence of violent deaths.[10] However, limited sociodemographic information is available on death certificates, and residence on death certificates is reported to the National Center for Health Statistics only at the county level.

Despite the fact that more precise information about the victim's local neighborhood, about the location where the crime occurred, and about the perpetrator would be desirable, we have shown significantly improved predictability of homicide rates relative to previous models. This is the first in-depth analysis to examine patterns of homicide for small geographic areas across the entire United States; through the sharing of information across the 800 small areas, we were able to describe patterns even in regions where Black male populations are sparse. Results point to a strong association between homicides and urbanization and economic conditions in all regions of the country for both Black and White males.

Our results are consistent with social disorganization theory and social deprivation theory, according to which homicides are more likely to occur in areas with unfavorable socioeconomic conditions. Although homicide rates have declined since 1992, the declines have been roughly parallel in different urbanization strata,[5] and it is unlikely that rankings of the broad regions reported here have changed substantially in just a few years. Thus, these results shed light on the potential correlates of high homicide rates in the United States in the near future. □

Contributors

C. Cubbin and L. W. Pickle planned the study design, analyzed the data, and wrote the paper. L. Fingerhut assisted with the study design and contributed to the writing of the paper.

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